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RIMMA MITELMAN
Reg. No. 34,396
Attorney for Applicant(s)

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PATENT
#99-0271-UNI
Case #C3900(C)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Edwards et al.
Serial No.:	09/525,083
Filed:	March 14, 2000
For:	WATER SOLUBLE PACKAGE

Edgewater, New Jersey 07020
August 15, 2000

SUBMISSION OF PRIORITY DOCUMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Pursuant to rule 55(b) of the Rules of Practice in Patent Cases, Applicant(s) is/are submitting herewith a certified copy of the United Kingdom Application No. 9906175.6 filed March 17, 1999, upon which the claim for priority under 35 U.S.C. § 119 was made in the United States.

It is respectfully requested that the priority document be made part of the file history.

Respectfully submitted,

Rimma Mitelman
Registration No. 34,396
Attorney for Applicant(s)

RM/mt
(201) 840-2671

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In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Dated 25 February 2000

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1.	Your reference	C 3900 (C) /sje
2.	Patent application number *(The Patent Office will fill in this part)*	**9906175.6** 17 MAR 1999
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	UNILEVER PLC UNILEVER HOUSE, BLACKFRIARS LONDON, EC4P 4BQ
	Patents ADP number *(if you know it)*	1628002
	If the applicant is a corporate body, give the country/state of its incorporation	UNITED KINGDOM
4.	Title of the invention	A WATER SOLUBLE PACKAGE
5.	Name of your agent *(if you have one)*	MOLE, Peter Geoffrey
	"Address for Service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	PATENT DEPARTMENT, UNILEVER PLC COLWORTH HOUSE, SHARNBROOK BEDFORD, MK44 1LQ
	Patents ADP number *(if you know it)*	1628003
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country / Priority application number *(if you know it)* / Date of filing *(day / month / year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application / Date of filing *(day/month/year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))*	YES

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	21
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Drawing(s)	5

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10. If you are also filing any of the following, state how may against each item.

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Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) Date: **17 March 1999**

Sandra Jane EDWARDS, Authorised Signatory

12. Name and daytime telephone number of person to contact in the United Kingdom — **Sandra Edwards 01234 22 2068**

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C3900

DUPLICATE

A WATER SOLUBLE PACKAGE

INTRODUCTION

The invention relates to capsules comprising a composition contained within a water-soluble envelope. In particular, the invention relates to a capsule containing a fluent substance and comprising a first sheet of water soluble material moulded to form a body portion of the capsule, and a second sheet of water soluble material superposed on the first sheet and sealed thereto by a closed seal along a continuous region of the superposed sheets.

Detergent compositions for the machine washing of laundry are provided in many forms. Probably the most prevalent form of laundry detergent is washing powder or granules. A problem with the use of these forms of detergent is that the product needs to be dosed into the machine in such a way that the detergent is quickly and thoroughly dissolved in the wash water of the machine without coming into contact with the laundry in a solid form. In this regard many dosing devices which overcome this problem have been proposed. One such device disclosed in European Patent Nos. 0 343 070 and 0 343 069 teaches the use of a flexible fabric sock which holds the particulate detergent in the machine, the fabric of the sock being permeable to water so as to allow water enter the sock and carry the detergent out of the sock through the fabric walls in the form of an aqueous solution. More recently unit dose forms of detergent have been proposed in the form of compressed tablets of detergent powder. A problem encountered with the provision of detergent tablets is that the tablets need to be strong enough to withstand storage and transport, yet weak enough to disintegrate and dissolve quickly in the washing machine.

A further problem is the need to prevent the tablets "posting" in the porthole and between the drums of conventional washing machines. More recently these problems have been overcome by the provision of detergent tablets having specific chemical disintegrants which allow quick disintegration of the tablets in the aqueous environment of a washing machine, and by the provision of loosely fitting net bags which aid tablet disintegration and prevent "posting". However, as many of the current detergent tablets contain bleach and other irritant substances, he problem of handling the tablets remains.

The provision of detergent compositions in water-soluble films has been known for some time. Most of the documents relating to this subject describe water soluble film envelopes formed using a vertical form-fill-seal (VFFS) route. A problem with envelopes produced using this VFFS method is that, due to the constraints of the process, the resultant envelopes have seals which incorporate defined weak points where the seals overlap at corners. This results in envelopes which are easily corrupted as a result of impacts suffered during transport. In an attempt to overcome the problems associated with such VFFS envelopes, European Patent Application No. 0 608 910 describes thermoformed water soluble packages for pesticidal compositions of the above mentioned type, which packages include a seal which does not have any angular intersections with inself. While this specification does provide a solution to the problem of weak seals, the thermoforming of water-soluble films results in formed packages having many other weak points. Moreover, the packaging and transport of such packages subjects the formed packages to considerable impact forces.

It is an object of the invention to overcome at least some of the above disadvantages. It is a particular object of the

invention to provide a capsule of the above-mentioned type which has greater rupture resistance compared to known water-soluble envelopes.

STATEMENTS OF INVENTION

According to the invention, there is provided a capsule containing a fluent substance and comprising a first sheet of water soluble material moulded to form a body portion of the capsule, and a second sheet of water soluble material superposed on the first sheet and sealed thereto by a closed seal along a continuous region of the superposed sheets, the capsule being characterised in that the body portion is generally dome shaped.

In a preferred embodiment of the invention, the body portion is generally hemispherical. In this instance, the height of the dome is preferably less than or equal to twice the radius of the hemisphere. Other dome shaped body portions according to the invention are envisaged. For example, dome shapes having rectangular, oval, square and triangular bases are envisaged. Generally when the dome shape is not hemispherical it is preferable that the height of the dome is less than or equal to the smallest diameter measured across a base of the dome. Generally, the base of the dome will be planar thereby providing an asymmetrical dome shape. Alternatively, the base may be concave or convex.

In one embodiment of the invention, the water-soluble film is polyvinyl alcohol, or a polyvinyl alcohol derivative. Preferably the film has a thickness of between 10 and 1000 microns. Ideally the film has a thickness of between 20 and 80 microns, most preferably between 40 and 60 microns. In

one embodiment of the invention, an exterior surface of the film is treated with BITREX.

The fluent composition contained within the capsule may be a liquid, a gel or a paste. Preferably the liquid is a liquid having a viscosity between 100 and 1000 centipoise, preferably between 300 and 800 centipoise, more preferably between 500 and 700 centipoise, and ideally about 600 centipoise, when measure at 20 degrees C at 105/seconds. In a preferred embodiment of the invention the fluent composition is present in an amount of between 10 and 500mls, preferably between 10 and 100mls, most preferably between 10 and 50mls. Suitably, the capsule contains between 20 and 30 mls of fluent composition. In a particularly preferred embodiment of the invention the fluent composition is a laundry treatment agent. Ideally the composition is non-aqueous, however the composition may comprise between 1 and 5% water

The invention also relates to a process for producing a capsule according to the invention, the process comprising the steps of:

- moulding a first sheet of water soluble material to form a body cavity of the capsule;
- placing the fluent composition in the body cavity;
- placing a second sheet of water soluble material across the body cavity;
- heat sealing the first and second sheets to form a closed water soluble seal along a continuous region of the superposed sheets,

the process being characterised in that the body cavity of the capsule is generally domed shape.

In a preferred embodiment of the invention, the first sheet of water-soluble material is moulded by means of thermoforming using a heating plate, wherein a heating surface of the heating plate is concave. Ideally, the sheet intimately contacts the sheet of water-soluble material, typically by applying a vacuum between the concave portion of the heating plate and the sheet of water-soluble material. Generally, the vacuum applied will be of less than 0.6 Bar. Alternatively the sheet may be blown into contact with the concave portion of the heating plate. On one embodiment of the invention, the process includes an additional step of, prior to the addition of the fluent composition, applying a vacuum to the moulded body cavity to maintain the shape of the cavity at least until the second sheet is sealed thereto.

The invention also relates to a process for the machine washing of laundry by employing a capsule according to the invention, wherein the fluent composition contained within the capsule comprises a laundry treatment agent, the process comprising the steps of:

- placing at least one capsule into the machine along with the laundry to be washed; and

- carrying out a washing operation.

Detailed Description of the Invention

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, in which the attached representations illustrate a number of different dome shapes according to the invention

EXAMPLE

In this example a thermoforming process is described where a number of packages according to the invention are produced from two sheets of water soluble material. In this regard recesses are formed in the sheet using a forming die having a plurality of cavities with dimensions corresponding generally to the dimensions of the packages to be produced. Further, a single heating plate is used for moulding the film for all the cavities, and in the same way a single sealing plate is described.

A first sheet of polyvinyl alcohol film is drawn over a forming die so that the film is placed over the plurality of forming cavities in the die. Each cavity is generally dome shape having a round edge, the edges of the cavities further being radiussed to remove any sharp edges which might damage the film during the forming or sealing steps of the process. Each cavity further includes a raised surrounding flange. In order to maximise package strength; the film is delivered to the forming die in a crease free form and with minimum tension. In the forming step, the film is heated to 100 to 120 degrees C, preferably approximately 110 degrees C, for up to 5 seconds, preferably approximately 700 micro seconds. A heating plate is used to heat the film, which plate is

positioned to superpose the forming die. The plate includes plurality concave depressions, which correspond to the recesses on the forming die. During this preheating step, a vacuum of 0.5 Bar is pulled through the pre-heating plate to ensure intimate contact between the film and the pre-heating plate, this intimate contact ensuring that the film is heated evenly and uniformly (the extent of the vacuum is dependant of the thermoforming conditions and the type of film used, however in the present context a vacuum of less than 0.6 bar was found to be suitable) Non-uniform heating results in a formed package having weak spots. In addition to the vacuum, it is possible to blow air against the film to force it into intimate contact with the preheating plate.

The thermoformed film is moulded into the cavities thus forming a plurality of recesses in the film which, once formed, are retained in their thermoformed orientation by the application of a vacuum through the walls of the cavities. This vacuum is maintained at least until the packages are sealed. Once the recesses are formed and held in position by the vacuum, the composition, in this case a non-aqueous liquid detergent is added to each of the recesses. A second sheet of polyvinyl alcohol film is then superposed on the first sheet across the filled recesses and heat-sealed thereto using a heating plate. In this case the heat sealing plate, which is generally flat, operates at a temperature of about 140 to 160 degrees centigrade, and contacts the films for 1 to 2 seconds and with a force of 8 to 30kg/cm2, preferably 10 to 20kg/cm2. The raised flanges surrounding each cavity ensures that the films are sealed together along the flange to form a continuous closed seal. The radiussed edge of each cavity is at least partly formed a by a resiliently deformable material, such as for example silicone rubber. This results in reduced force being applied

at the inner edge of the sealing flange to avoid heat/pressure damage to the film.

Once sealed, the packages formed are separated from the web of sheet film using cutting means. At this stage it is possible to release the vacuum on the die, and eject the formed packages from the forming die. In this way the packages are formed, filled and sealed while nesting in the forming die. In addition they may be cut while in the forming die as well.

During the forming, filling and sealing steps of the process, the relative humidity of the atmosphere is maintained at a relatively low level to ensure that the films have a relatively low degree of plasticisation and as such tend to be stiffer resulting in easier handling. The actual specific RH of the atmosphere needed will vary according to the temperature of the environment and the type of film used, however for temperatures in the region of 20 degrees C, the RH should be in the region of 30 to 50% depending on the thickness and elasticity of the film.

The sealed packages are conditioned after sealing and prior to and during packaging within a secondary packaging. Thus, once sealed the RH of the atmosphere is raised relative to the RH of the atmosphere prior to sealing. The actual RH required to adequately condition the packages depends to a large extent on the temperature of the environment, and the type of film used. As an example, considering a temperature of 20 degrees C, and a conventional film of thickness about 76 microns, the RH should be raised to greater than 50%, preferably about 70 to 80%. The formed packages should be conditioned in this atmosphere for a period of time sufficient to plasticise the water-soluble film to a degree where it is rendered less brittle and more impact resistant.

Ideally, the packages are packed within the secondary pack within the conditioning environment so that the conditioned atmosphere is sealed into secondary packs thus allowing the packages equilibrate further with the conditioned atmosphere. In this regard the secondary pack should include a moisture barrier, preferably a moisture barrier having a MVTR in the region of 1 to 20 g/m2/24hours. Suitable packaging substrates having MVTR values in this range will be known to those skilled in the art. The above pre-sealing and post-sealing conditioning conditions are applicable to packages formed using the VFFS process of the prior art.

A) Resonance Frequency

For all vibrational stress particularly at the resonance frequencies of pack or product, vibrational energy will manifest itself by producing waves in the film forming the encapsulate, In a 3D shape there are various places where 2 or more such waves will intersect. Such intersection when in phase produces the sum of the energy of all the waves intersecting concentrated at the point of intersection, greatly increasing the possibility of rupture at this point. For a sphere there are no points where such wave intersection takes place, for a segment of a sphere or a hemisphere there is only one place and that is the circular drawing between the flat top and the curved base. All other shapes combining 2 surfaces, one flat and one 3 dimensional, will also have the same intersection point as well as others produced by other planes, edges and corner contained in the shape. Intermediate shapes, those that have a non-circular plan but a sphere segment vertical section, (see diagram) will have almost the same advantage in the above respect as the sphere segment or hemisphere, but in addition to the join of flat topped curve base there will be other possible other wave intersection points; at corners (a, b, c, etc.)

for a small part of the curve base in immediate proximity to the drawing.

B) Abrasion

Whatever the shape or size of the encapsulate it will always be exposed to abrasion or scuffing during its life. This may occur during manufacture or during use and certainly in transport and storage due to contact with outer packaging or other encapsulates. Dome shapes according to the invention will minimise the occurrences and severity of abrasion because of its uniform surface and absence of edges and corners more likely to come into contact with each other and outer packaging. The contact with the curved surface of the dome packages according to the invention will be tangential and less severe. Again as above, those intermediate shapes, as described above, will have most of the advantages of the sphere's segment but not quite so much.

C) Seal Weak Points

Fig.1

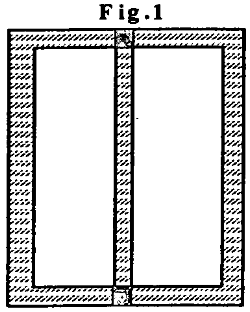


Fig.2

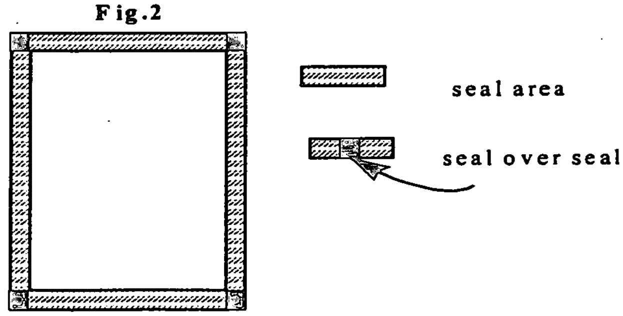
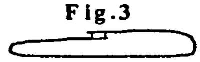


Fig.3



All methods of making an encapsulate to hold liquid or gel product, involves sealing together 2 edges of the film

used. In some forms, for example, 2 web vertical formed fill seal, one seal is made across another, (Fig.2) in the case of fin seals as in a single web vertical form fill seal, the seal is made between two film layers at the edge and three film layers at the centre (Fig's. 1 & 3). In all the above cases the seal area has weak points. These will be those areas where one seal has been made over another (Fig's. 1 & 2 above) or the changing layers of seal (Fig.3) above. The sealing parameters of which cannot be optimum for both 2 layer and 3 layer seals, which must certainly produce weak points. With water dispersible film this is particularly so, as sealing parameters are critical and within fairly narrow limits. For those encapsulates made from 2 sheets, one flat and one formed, by a continuous perimeter seal, the circular seal is the only one completely uniform at all points and has no point at which applied or impact stress may be concentrated, and so has no weak points.

D) Thinning

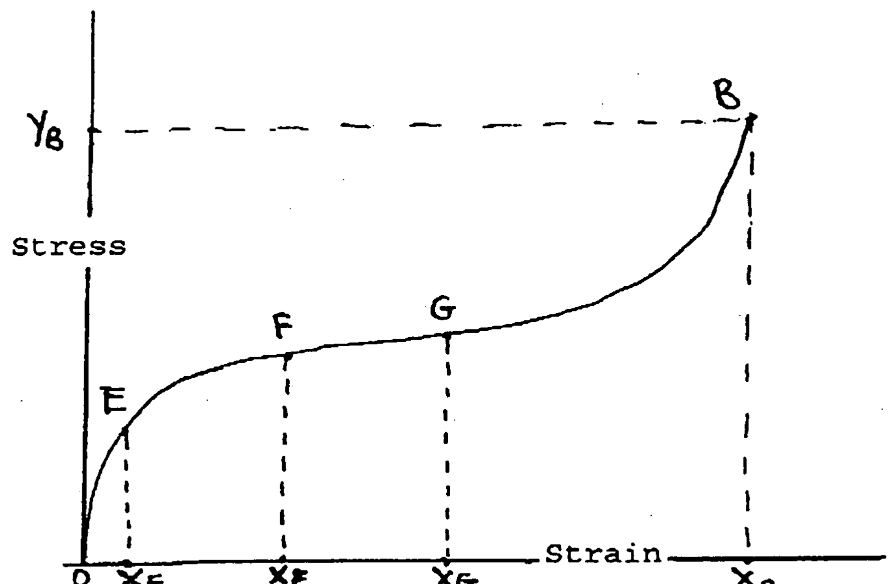
When a flat web of thermoplastic film is thermoformed into a 3 dimensional shape, the formed part is reduced in thickness. The deeper the form the greater this thinning will be. It has been found that for forming shapes that contain tight curves, corners or edges the associated thinning is greatest. The more restricted the edge or corner the greater the thinning produced, conversely the more generous the curves and corners the less thinning produced. The shape that has the least thinning then must be a section of a sphere as there are no edges or corners and the curves are the most generous possible for the given volume. For such a section therefore the thinning is uniform and a minimum and there are no thin spots. It is well known that the tensile or break strength of

plastics films is proportional to the thickness so that any thin spots or area will be weak point which will rupture at a lower impact level. It has been found that a dome shape is the design which will withstand the greatest impact. This is demonstrated in the section below entitled "Experimental Determination of Thinning".

E) Energy Absorption

In the above it was shown that the dome shape was more robust than other shapes as there was less thinning and less degree of thinning locally and thus less liable to rupture on impact. This is reinforced by the characteristics of the film used. Using PVOH as a preferred film, a typical stress strain curve is shown figure 4. The work done in breaking the film is given by the area under the curve between $x=0$ and $x=X_B$. When the film is formed the film will not return to its unformed condition and has therefore been taken past its elastic limit E. This means that after forming the condition of the film no longer returns to zero to $x=0$ on the stress strain curve, but to a point somewhere between $x=X_E$ and $x=B$ in Figure 4. When such a film is stressed the work done to rupture is now the area under the curve between the points E and B. Less than for the unformed film. For a forming a sphere section the amount of thinning is less than for any other shape as has been described above. As the thinning is the strain produced by the applied stress, it means that X_F (sphere section) **must** be lower than X_G of any other shape. This being the case the work done in rupturing the sphere section is greater than that for any other shape. The differences being the area bounded by the points X_F, F, G, X_G. Again intermediate shapes as described above will be intermediate between these 2 alternatives.

Fig. 4



E is elastic limit

B is the point of break

Y_B is stress at break

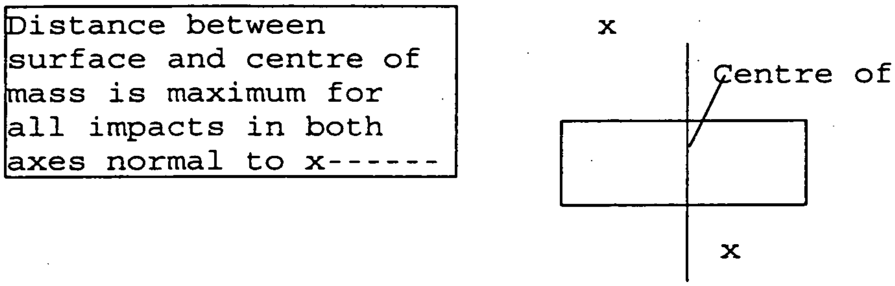
X_B is strain at break

F) Energy Dissipation

It is known that when kinetic energy is dissipated by impact the maximum stress level that is implied to the imparted body is a function of the time over which it occurs. The longer the duration of the acceleration (deceleration) caused by the impact the lower the maximum stress level applied. For flexible envelopes containing liquids (or gels) the impulse time is proportional to the distance between the point of impact and the centre of mass as the liquid within the envelope can move without breach of the envelope. As small packs tend to be more randomly oriented in any uncontrolled situation, it follows that the most robust design is that which has the greatest distance between the centre of mass and the

surface of the envelope in all orientations. This shape is of necessity, the sphere. For designs such as we are considering here mainly containing one planar surface it must be the hemisphere. Again this applies to intermediate shapes to a slighter lesser degree.

Fig. 5



G) Recovery

For thermoformable films particularly elastic ones, and more particularly pvoh, after thermoforming they have a tendency to recover their original shape under certain conditions e.g. as temperature or humidity rise. Such recovery with a sphere section forming is uniform and does not unduly affect the appearance while for other shapes this is not so, as those section corners edges etc. that are thinned to a greater degree tend to recover less than those areas not so thinned.

H) Non-Deformity

One of the problems of flexible plastic films particularly pvoh is that at low temperature (below 10°C) the film becomes progressively less elastic and more subject to stress cracking. When flexible envelopes containing a fluid product are packed randomly in an outer form of packaging there is a finite probability that some of them will be folded over on themselves forming a crease in the

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film, this is a situation that will cause rupture through stress cracking at lower temperatures. The sphere section envelope is the least prone to this type of deformation as it has no corners or other protruding design features which are liable to be formed or creased. Other methods of making envelopes not thermoformed e.g. by vertical forming, are even worse from this point of view. Intermediate shaped formings as defined above have the same advantage.

I) Furthermore, in multiple outer packaging dome shapes cannot be packed in a space efficient way which means they are of necessity when packed must include a considerable amount of empty interstitial space. This is important, as for the impact resistance of multiples in outer packs such interstitial space is a critical requirement.

J) Circular Seals Means Less Seal Area

Seals are the slowest dissolving part of the envelope so the circular seal optimises the dissolution time.

Once the base web has been formed and product filled there will be some residual tension in the formed base web however slight. Such tensions it is known can produce inconsistent seals if they are great enough. With the sphere section these tensions will be uniform about the sealing surface and therefore less likely to cause sealing inconsistencies than other shapes.

K) As the sphere section provides the lowest surface area to volume ratio it uses less film per unit pack

L) Film inconsistencies

All commercially films particularly pvoh film have a certain level of inconsistencies in the film. Such things as foreign bodies, air bubbles or gel spots although rare with good quality films, such defects do occur. For film of the normal thickness this is unlikely to cause a problem in most cases, however, should such a film be subjected to thinning due to thermoforming then as the thinning progresses such a film defect can become more of a problem, a weak point, or even a rupture. Naturally, the more the film is thinned the greater the possibility of this occurrence. The segment of the sphere shape is therefore the safest from this point of view as it is thinned less and has no points thinner than others.

EXPERIMENTAL DETERMINATION OF THINNING

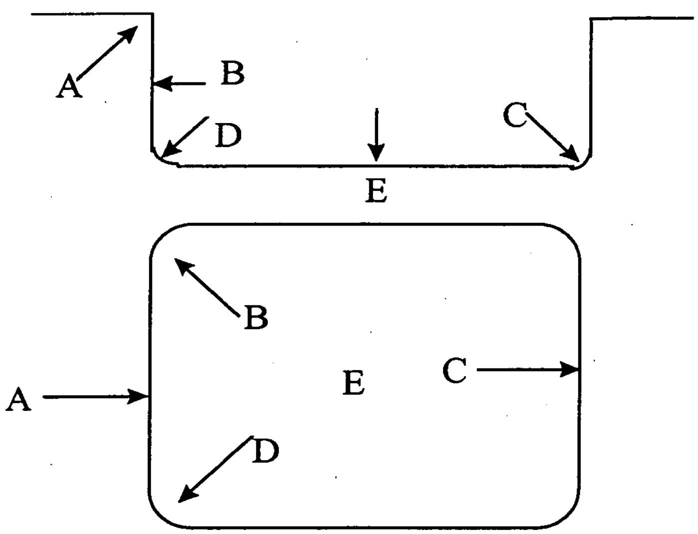
The objective of this work was to create thermoformings of different shapes, including hemispherical, out of the same material under the same conditions with the same depth of draw and approximately the same volume.

Having prepared these formings they were then tested for thickness at specific points in the formed shape by micrometer. The results were then compared between shapes,

The conditions used were:

Film:	CC8534 pvoh 75μ thick
Volume of cavity:	Approx. 30cc
Atmospheric condition:	17°C 46% r.h.
Micrometer sensitivity:	5μ

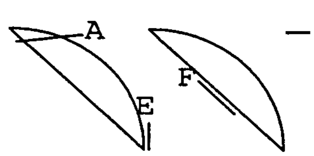
Measurement points



A Flat side just below seal
B Vertical edge
C Horizontal edge (base)

The rectangular shape shown is used only as an example to show the various points.

For a hemisphere only points A & E are the same. All other points are the same. In the test they were represented by Point F below.



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The results were the following:

			Measurement in microns					
Shape	**Sample**	**Draw Depth**	**A**	**B**	**C**	**D**	**E**	**F**
Hemisphere	1	20mm	60				70	65
	2	"	65				60	65
	3	"	65				60	60
Triangle	1	"	50	50	45	30	65	
	2	"	55	55	40	25	55	
	3	"	55	55	40	25	60	
Hemisphere	4	25mm	60				70	70
	5	"	65				70	70
	6	"	65				65	70
Cube	1	"	55	40	20	15	35	
	2	"	65	35	25	20	35	
	3	"	60	40	25	20	40	

These results show that while thinning always takes place on thermoforming

a) for the hemisphere shape thinning is uniform
b) the hemisphere has a lower level of thinning than the others

i.e. Maximum thinning for Hemisphere = 20%
Maximum thinning for Triangle = 60%
Maximum thinning for Cube = 80%

Impact Testing

The objective of this test was to show any differences, which exist, between the impact resistance of the hemisphere shape and other shapes.

A falling dart impact test was used.

The test specimen was placed on a hard surface immediately below the suspended dart. The dart was allowed to fall,

striking the specimen centrally. The specimen was then examined and any rupture or leak recorded. If there was no rupture or leak, the specimen was subjected to successive impacts, each at a higher dart weight, until rupture did occur.

Three shapes of encapsulate were used, all of the same material, fill and approximate weight and size. The test was repeated on both sides of the encapsulate and several replicates tested and a mean taken.

Before test all specimens were exposed to the conditions of the test site for 12 hours to reach equilibrium.

Test details were: Dart smooth hemispherical impact surface of 38mm dia.

Drop height: 615mm
Surface: Smooth non-resilient plate
Temperature: 20°C - Relative Humidity - 70%

Three shapes were tested:

1) Hemisphere
2) Triangle
3) Cube

Each made out of CC8534 film of 75micron thickness with a approximate weight of 25 gsm.

Results were as follows:

Sample	Shape	Orientation	No. of Drops	Dart Weight to Rupture	Observations
1	Hemisphere	Base Up	3	250 gms	Small hole mid base
2	Triangle	"	2	150	2 holes in edges
3	Cube	"	2	150	3 or more holes in corners & edge
4	Hemisphere	Base Down	4	350	hole in base

The above results show that the impact resistance of hemisphere is greater than the cube or triangle

The difference between hemisphere and triangle is further demonstrated by smaller dart weight increments and a larger result base.

SECONDARY PACKAGING TEST

Objective	To establish any difference in impact survival between dome shaped capsules and triangle capsules of liquid detergent product in water soluble film encapsulates when multiples are contained in fibreboard box.
Method	22 encapsulates of Limpopo product sealed in water soluble film of hemispherical shape were placed randomly in a fibreboard box. The box was made of "M-flute" material of dimensions 170 x 85 x 54 mm which had a total filled weight of 609 gms. The box was sealed closed and subjected to a vertical drop of 1-2 m on to a hard flat surface on the short dimensions. This test was repeated for triangle shaped encapsulates of the same weight and film.

Results

Hemisphere

3 of the 22 were leaking although rupture was minute

Triangle

7 of the 22 were leaking and in 5 cases leakage was catastrophic

Conclusions

Hemisphere shape appears to be a more resistant one than the triangle for this type of impact.

The invention is not limited to the embodiment hereinbefore described which may be varied in both construction and detail without departing from the spirit of the invention.

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CLAIMS

1. A capsule containing a composition and comprising a first sheet of water soluble material moulded to form a body portion of the capsule, and a second sheet of water soluble material superposed on the first sheet and sealed thereto by a closed seal along a continuous region of the superposed sheets, the capsule being characterised in that the body portion is generally dome shaped.

2. A capsule as claimed in claim 1 wherein the body portion is generally hemispherical.

3. A capsule as claimed in claim 2 in which the height of the dome is less than or equal to twice the radius of the hemisphere.

4. A capsule as claimed in claim 1 in which the body portion is a generally oval dome shape.

5. A capsule as claimed in any preceding claim in which the second sheet of water-soluble material forms a base of the capsule.

6. A capsule as claimed in claim 5 in which the base is generally flat, or slightly concave or convex.

7. A capsule as claimed in any preceding claim in which the water-soluble film comprises polyvinyl alcohol.

8. A capsule as claimed in any preceding claim in which the substance is a liquid, paste or a gel.

9. A process for producing a capsule containing a composition, the process comprising the steps of:

- moulding a first sheet of water soluble material to form at least one recess in the sheet;

- placing the fluent composition in the at least one recess;

- placing a second sheet of water soluble material across the at least one recess;

- heat sealing the first and second sheets to form a closed water soluble seal along a continuous region of the superposed sheets,

the process being characterised in that the capsule is generally domed shape.

10. A process as claimed in claim 9 in which the body cavity is generally hemispherical.

11. A process as claimed in claims 9 or 10 in which the first sheet of water-soluble material is moulded by means of thermoforming using a heating plate, wherein a heating surface of the heating plate is concave.

12. A process as claimed in any of claims 9 to 11 in which prior to the addition of the composition a vacuum is applied to the moulded body cavity to maintain the shape of the cavity at least until the second sheet is sealed thereto.

13. A process for the machine washing of laundry by employing a capsule according to any of claims 1 to 8,

- wherein the fluent composition contained within the capsule comprises a laundry treatment agent, the process comprising the steps of:

- placing at least one capsule into the machine along

- with the laundry to be washed; and

- carrying out a washing operation.

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ABSTRACT

A capsule containing a fluent detergent composition comprises a first sheet of water soluble material moulded to form a body of the capsule, and a second sheet of water soluble material superposed on the first sheet and sealed thereto by a closed seal along a continuous region of the superposed sheets. The capsule is generally dome shaped.

Fig. 1a   Fig. 1b

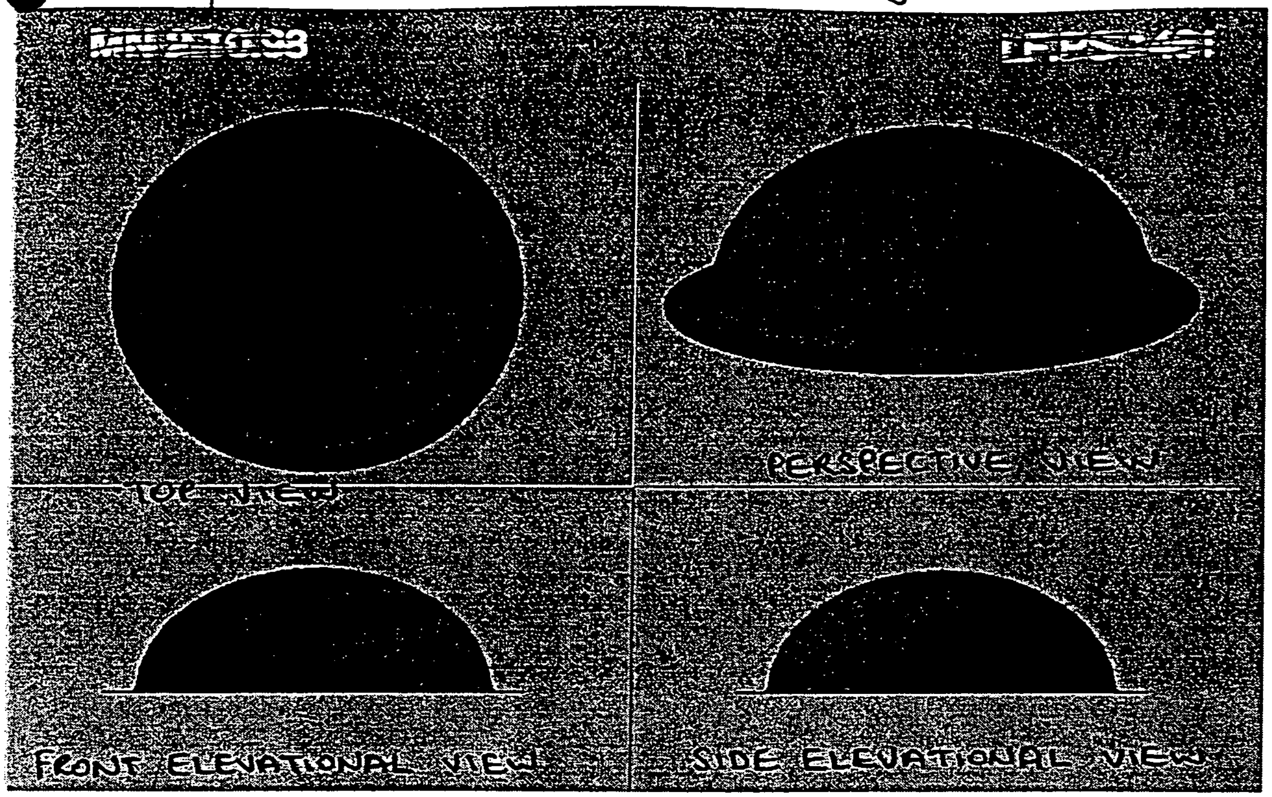

Fig. 1c   Fig. 1d

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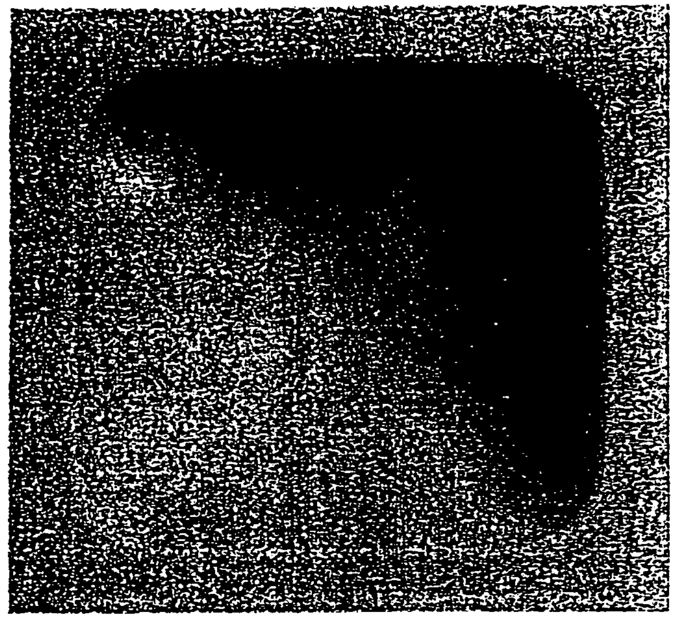

Fig. 2a

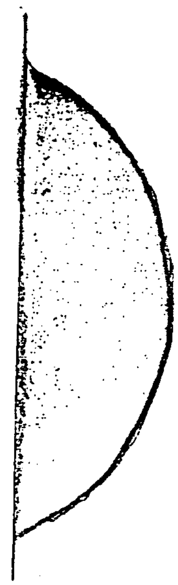

Fig. 2b

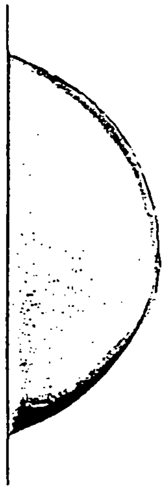

Fig 2c

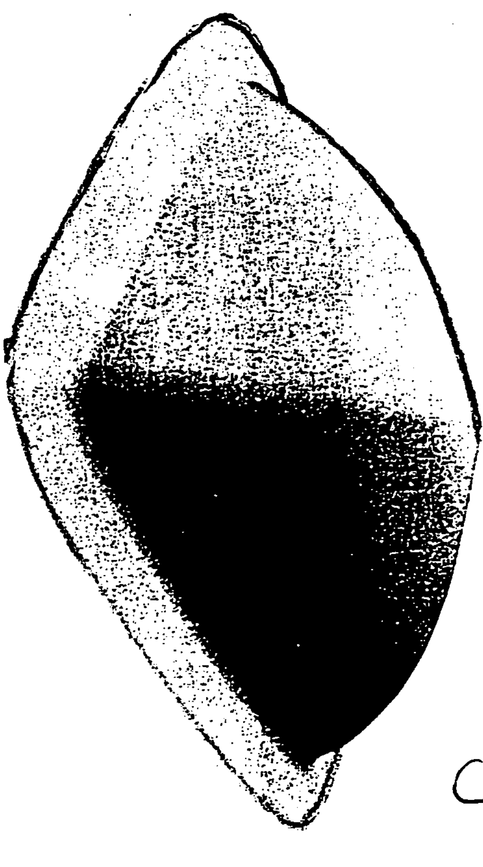

Fig. 2d

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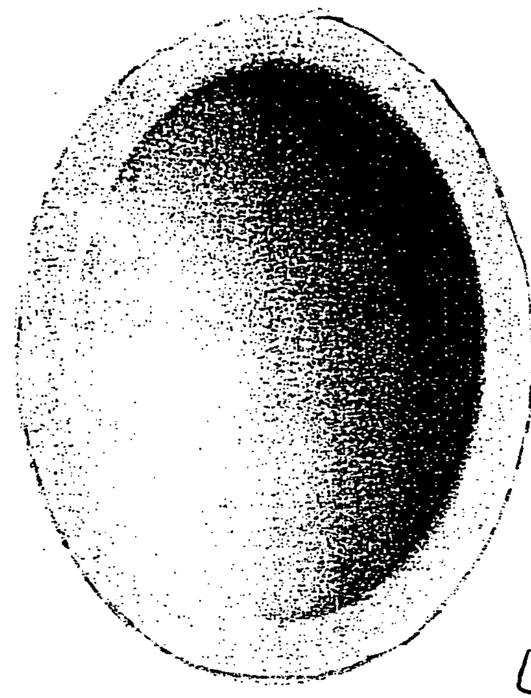

Fig. 3a

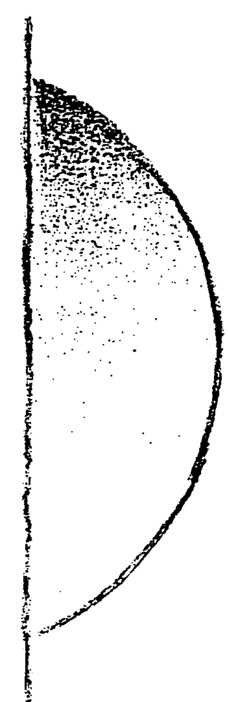

Fig. 3b

Fig. 3c

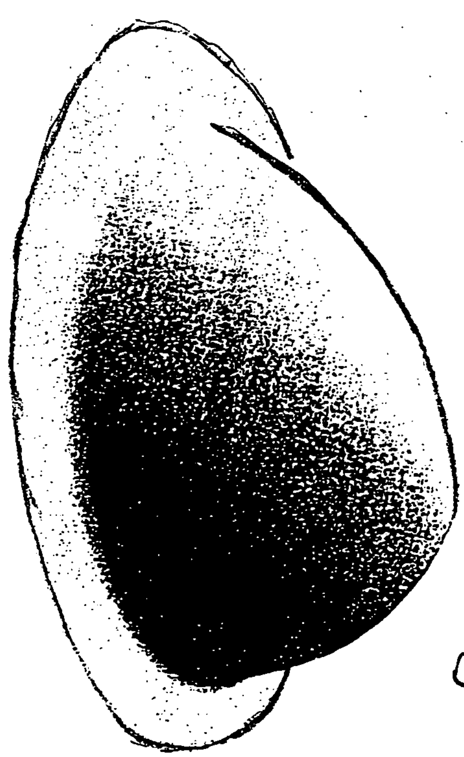

Fig. 3d

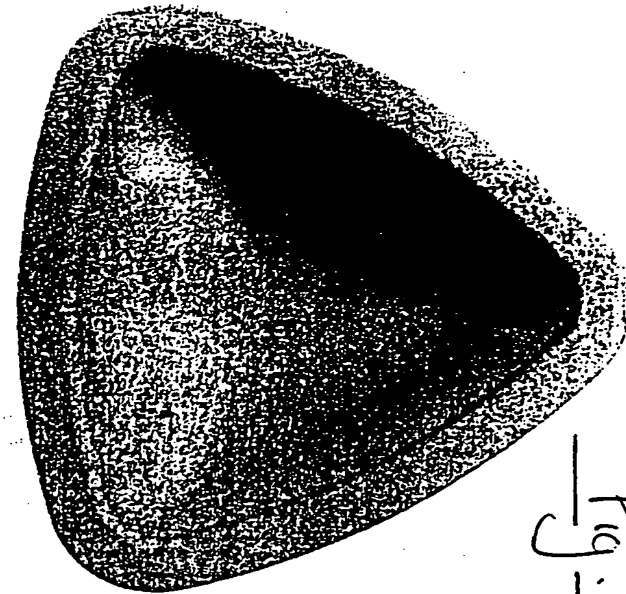

Fig. 4a

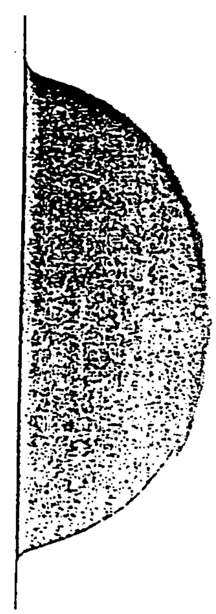

Fig. 4b

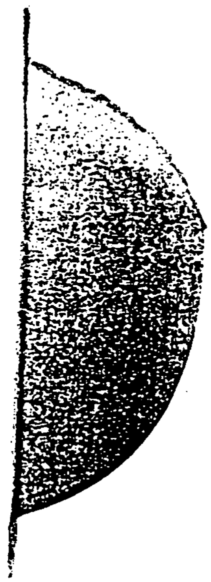

Fig 4c

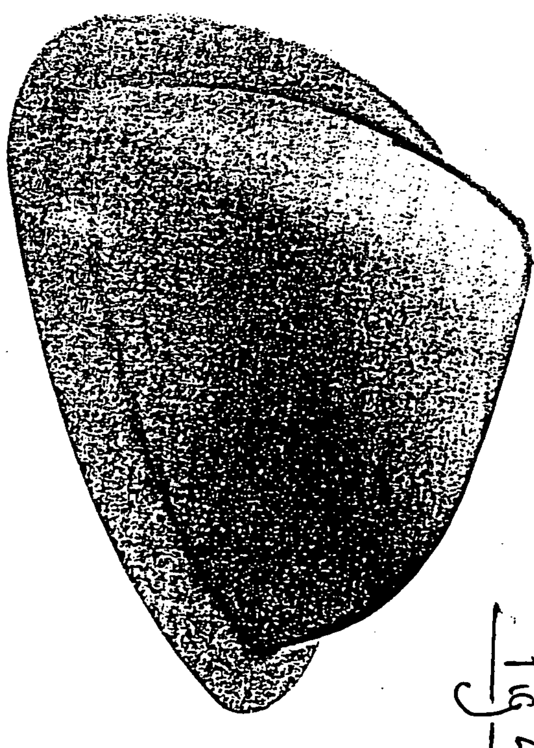

Fig 4d

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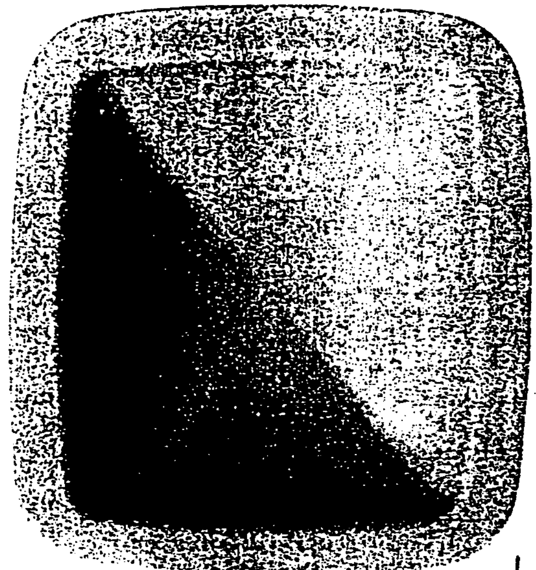

Fig 5a

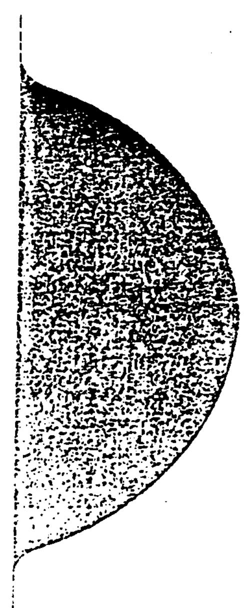

Fig 5b

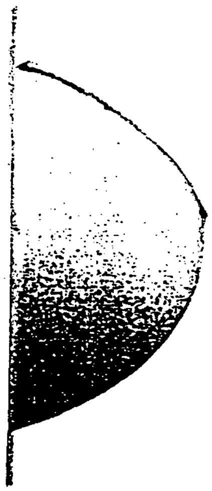

Fig. 5c

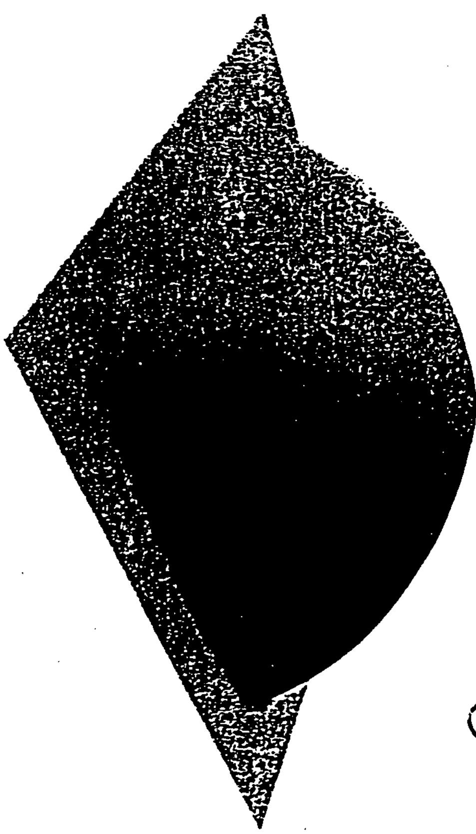

Fig 5d